Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army											Date: March 2019	
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 7: *Operational Systems Development*					R-1 Program Element (Number/Name) PE 0607131A *I Weapons and Munitions Product Improvement Programs*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	-	16.302	18.551	15.645	-	15.645	10.197	8.833	8.721	2.989	Continuing	Continuing
ER2: *Close Combat Technology*	-	4.408	3.143	2.056	-	2.056	0.000	0.000	0.000	0.000	Continuing	Continuing
ER5: *Indirect Fire and Fuze Technology*	-	3.540	2.817	5.064	-	5.064	4.468	2.241	2.308	0.000	Continuing	Continuing
ER6: *Direct Fire Technology*	-	8.354	12.591	8.525	-	8.525	5.729	6.592	6.413	2.989	Continuing	Continuing

A. Mission Description and Budget Item Justification

Project ER2: The Close Combat Technology program includes development efforts to upgrade Close Combat technologies, energetics, and munitions, such as counter explosives, grenades, demolitions, shoulder launched munitions, pyrotechnic simulators, countermeasure flares, non-lethal ammunition/systems, networked munitions and mines, that have been fielded or have received approval for full rate production. This program will identify, characterize, study, analyze, test and develop technologies to resolve close combat munition reliability, safety, environmental, storage, standardization, obsolescence and manufacturing/producibility issues.

FY 2020 funds resource improvements to XM111 Offensive Hand Grenade.

Project ER5: The Indirect Fire and Fuze Technology Project includes product improvement development efforts to upgrade indirect fire weapon systems and munitions that have already been fielded and/or are in production. Initiatives include improved target engagement, increased reliability, availability, maintainability, and safety, standardization and interoperability with weapons and munitions of Allied Nations, defense exportability features, reduction of failure mechanisms, and supply chain risk through introduction of new and alternative technology and materiel solutions, improvement of manufacturing methods and their associated production and life cycle support processes, new capabilities in response to the evolving and emerging threats and countermeasures, and reduction/elimination of potential environmental and health risks associated with these products. FY 2020 funds will support engineering testing and evaluation on replacement electronic transceiver prototypes for indirect and direct fire proximity fuzes, testing on optimized impact switches for use in mortar and medium caliber fuzes that will improve producibility, testing of the medium caliber fuze safety design modifications, analysis of prototype low cost electronic safe and arm devices, analysis on hand grenade fuzes to reduce the number of critical defects that will improve producibility and increase safety, and evaluations on the next generation microcontroller to replace a one-time programmable component due to part obsolescence for mortar proximity fuzes. FY 2020 funds will also support qualification of Hexachloroethane Titanium Oxide (HX) smoke fill formulation into the 81mm smoke family of ammunitions. Engineering efforts will identify the formulation percentage of constituents and identify the production processes required to promote effective smoke production that is less toxic and ultimately provides effective smoke screening and burn time performance. FY 2020 funds will also support reliability improvements and increased range within current fielded Artillery and Mortar Conventional Ammunition.

Project ER6: The Direct Fire Technology funding will be used to support direct fire ammunition from small caliber ammunition, 40mm grenade, medium caliber cannon ammunition and large caliber ammunition enhancements to lethality, effectiveness, survivability, accuracy and general product improvements. FY 2020 funds are used for a more lethal and safer design for 40mm grenades that will be built and tested. Warhead improvement and primer improvement for 30mm ammunition are also

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Army	Date: March 2019
Appropriation/Budget Activity 2040: *Research, Development, Test & Evaluation, Army I* BA 7: *Operational Systems Development*	**R-1 Program Element (Number/Name)** PE 0607131A *I Weapons and Munitions Product Improvement Programs*

under development. A number of improvements for training ammunition, environmentally friendly primers, and lightweight small caliber ammunition will continue to be developed. Potential improvements to 105mm and 120mm ammunition will be examined.

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	15.738	18.570	12.740	-	12.740
Current President's Budget	16.302	18.551	15.645	-	15.645
Total Adjustments	0.564	-0.019	2.905	-	2.905
• Congressional General Reductions	-0.013	-0.019			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	1.187	-			
• SBIR/STTR Transfer	-0.610	-			
• Adjustments to Budget Years	-	-	2.905	-	2.905

Change Summary Explanation

FY 2020 increase of $2.905 million includes the following budget adjustments:
$0.323 million decrease to Project ER5: Indirect Fire and Fuze Technology.
$3.228 million increase to Project ER6: Direct Fire Technology.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607131A / *Weapons and Munitions Product Improvement Programs*	Project (Number/Name) ER2 / *Close Combat Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
ER2: *Close Combat Technology*	-	4.408	3.143	2.056	-	2.056	0.000	0.000	0.000	0.000	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

This Project includes development efforts to upgrade Close Combat technologies, energetics, and munitions, such as counter explosives, grenades, demolitions, shoulder launched munitions, pyrotechnic simulators, countermeasure flares, non-lethal ammunition/systems, networked munitions and mines, that have been fielded or have received approval for full rate production. This Project will identify, characterize, study, analyze, test and develop technologies to resolve close combat munition reliability, safety, environmental, storage, standardization, obsolescence and manufacturing/producibility issues.

FY 2020 funds will resource improvements to XM111 Offensive Hand Grenade.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: MK3A2 Replacement, XM111 Offensive Hand Grenade	2.617	1.157	2.056	-	2.056
Description: The current MK3A2 Offensive Hand Grenade can expose the Warfighter to toxic levels of asbestos and is restricted for use in Continental United States and Outside Continental United State (CONUS/OCONUS). The warfighter cannot safely employ this grenade. Alternate munitions do not satisfy user requirements for incapacitating the enemy. This effort incorporates modern materials and insensitive explosives to provide a safer, producible offensive grenade and its associated training device, XM112. ***FY 2019 Plans:*** Complete Type Classification/Full Material Release (TC/FMR) documentation. ***FY 2020 Base Plans:*** Build and test prototypes for qualification of alternate explosive fill. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 funds are needed to build and test prototypes for the qualification of an alternate fill (based on obsolescence risk against current fill).					
Title: Countermeasure Flare Decoy Formulations	1.570	-	-	-	-
Description: Improve the producibility of countermeasure (CM) decoy formulations in order to increase the production safety and functional reliability to protect aircraft against multiple threat systems.					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER2 / *Close Combat Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: AN-M8A1 Obscuration Grenade ***Description:*** This effort supports the Design/Type Classification/Production Prove Out of an improved obscurant grenade that provides the warfighter with screening performance approaching that of the legacy AN-M8 smoke grenade, using a different smoke formulation than the legacy's grenade's Hexachloroethane (HC). The use of HC has been restricted inside and outside the Continental United States (CONUS/OCONUS) due to its toxic effects. The legacy AN-M8 grenade is limited to use in contingency operations only. The M83 training smoke grenade is currently used in lieu of the AN-M8 in both training and tactical operations, but does not give screening performance comparable to the legacy AN-M8. Soldiers must use two or three M8 grenades to produce obscuration effects comparable to a single AN-M8 grenade. ***FY 2019 Plans:*** Complete Inhalation and Ecological Toxicity Assessments of new Hexachloroethane Titanium Oxide (HX) smoke formulation. Review and revalidate User requirements. Complete Phase-I Technical Data Package (TDP) scrub. Conduct performance tests and final adjustments to smoke formulation. Initiate starter cup development and conduct fuze assessment. Coordinate with Pine Bluff Arsenal (PBA) to ensure PBA programs for required production facility upgrades in synchronization with Project Manager Close Combat Systems (PM CCS) program objectives to establish an AN-M8A1 production capability that currently does not exist. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** No funding allotted for this effort.	0.161	1.266	-	-	-
Title: M82 Simulant Smoke Practice Grenade ***Description:*** The M82 encountered performance issues during the last production as a result of the less than optimal design for the base. Developing a new base design that minimizes any leak paths and facilitates the metal clip contact surface with the launcher will greatly improve the producibility and reliability of the grenade. This effort consists of the development and prove out of the base design. ***FY 2019 Plans:*** Develop base design, procure mold and parts for testing. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Effort complete.	-	0.619	-	-	-
Title: Family of Scatterable Mines (FASCAM)	0.060	-	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER2 / *Close Combat Technology*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Description: This effort supports the development of a new Deep Terrain Shaping Obstacle (DTSO). The current Deep Terrain Shaping Obstacle in the U.S. inventory has a life expectancy of 36 years (losing capability in 2025). The methods used to make this determination are unknown. Testing effort is to determine the actual life expectancy and effectiveness of the current Deep Terrain Shaping Obstacle system in order to decide when a replacement capability needs to be fielded. In parallel, evaluation the technical data package and determining the cost of producing additional units of the current Deep Terrain Shaping Obstacle.					
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.101	-	-	-
Accomplishments/Planned Programs Subtotals	4.408	3.143	2.056	-	2.056

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• E33010: *GRENADE, Hand, Offensive, XM111*	-	-	0.000	2.310	2.310	5.700	13.570	12.120	13.834	0.000	47.534

Remarks

D. Acquisition Strategy

The strategy for the MK3A2 Offensive Hand Grenade is to develop, test and qualify a new design, XM111, that eliminates the toxic hazards and provides the required performance for the user in FY 2019. Follow-on procurement efforts will be competitive pending market research.
The strategy for the AN-M8A1 is to qualify an alternative fill due to obsolescence and manufacturability driven changes required to provide smoke for use by Soldiers to meet existing validated requirements. Once the smoke fill is qualified, the plan is to investigate the cost and impact to upgrade the Pine Bluff Arsenal grenade loading facilities
The M82 program is updating the design of specific parts to make it more producible and will be proving out the design for use in future production efforts.

E. Performance Metrics

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607131A / *Weapons and Munitions Product Improvement Programs*	Project (Number/Name) ER2 / *Close Combat Technology*	

Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
M82 Simulant Smoke Practice Grenade Improved Propellant Retainer	TBD	PM CCS : Picatinny Arsenal,NJ	-	-		0.028	Mar 2019	-		-		-	0.000	0.028	-
MK3A2 Replacement, XM111, Offensive Hand Grenade	TBD	PM CCS : Picatinny Arseanl, NJ	-	-		0.507	Sep 2019	-		-		-	0.000	0.507	-
		Subtotal	-	-		0.535		-		-		-	0.000	0.535	N/A

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Claymore Force-on-Force TADSS Trainer - Design, Develop and Deliver a Production Prototype	MIPR	ARDEC : Picatinny Arsenal, NJ	1.267	-		-		-		-		-	Continuing	Continuing	-
MK3A2 Replacement, XM111, Offensive Hand Grenade	C/FFP	Battelle Memorial Institute : Columbus, OH	0.548	-		-		0.450	Feb 2020	-		0.450	Continuing	Continuing	-
M82 Simulant Smoke Practice Grenade Improved Propellant Retainer	MIPR	DoD Ordnance Technology consortium (DOTC)-TBD : Various	-	-		0.100	Jun 2019	-		-		-	0.000	0.100	-
FY 2019 SBIR / STTR Transfer	TBD	TBD : TBD	-	-		0.101		-		-		-	0.000	0.101	-
		Subtotal	1.815	-		0.201		0.450		-		0.450	Continuing	Continuing	N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607131A / *Weapons and Munitions Product Improvement Programs*	Project (Number/Name) ER2 / *Close Combat Technology*	

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MK3A2 Replacement, XM111, Offensive Hand Grenade	MIPR	ARDEC : Picatinny Arsenal, NJ	1.227	1.668	May 2018	0.485	Feb 2019	1.162	Jan 2020	-		1.162	Continuing	Continuing	-
Countermeasure Flare Decoy Formulations	MIPR	ARDEC : Picatinny Arsenal, NJ	0.269	1.098	Jun 2018	-		-		-		-	Continuing	Continuing	-
AN-M8A1 Enhanced Obscuration Grenade	MIPR	ARDEC : Picatinny Arsenal, NJ	0.125	0.020	Apr 2018	0.521	Mar 2019	-		-		-	Continuing	Continuing	-
AN-M8A1 Enhanced Obscuration Grenade	MIPR	ECBC : Edgewood, MD	-	0.141	Jun 2018	0.745	Mar 2019	-		-		-	Continuing	Continuing	-
AN-M8A1 Enhanced Obscuration Grenade	MIPR	Pine Bluff : Pine Bluff Arsenal	0.067	-		-		-		-		-	Continuing	Continuing	-
MK3A2 Replacement, XM111, Offensive Hand Grenade	MIPR	Defense Information Technical Center : Fort Belvoir, VA	0.008	-		-		-		-		-	Continuing	Continuing	-
M82 Simulant Smoke Practice Grenade Improved Propellant Retainer	MIPR	ECBC : Edgewood, MD	-	-		0.095	Feb 2019	-		-		-	Continuing	Continuing	-
M82 Simulant Smoke Practice Grenade Improved Propellant Retainer	MIPR	Pine Bluff Arsenal : PBA, AR	-	-		0.099	Dec 2019	-		-		-	Continuing	Continuing	-
FASCAM Study - Mine Design and Producibility Review	C/CPFF	Savit : Rockaway, NJ	0.401	-		-		-		-		-	Continuing	Continuing	-
FASCAM Study - Gator Landmine System Reliability Review	MIPR	ARDEC : Picatinny Arsenal, NJ	0.440	-		-		-		-		-	Continuing	Continuing	-
FASCAM Study - GATOR Drop Test	MIPR	ARDEC : Picatinny Arsenal, NJ	0.160	-		-		-		-		-	Continuing	Continuing	-
MK3A2 Replacement, XM111, Offensive Hand Grenade	MIPR	Nova Tech : NJ	0.104	-		-		-		-		-	Continuing	Continuing	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER2 / *Close Combat Technology*	

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FASCAM Study - YPG Gator Component Testing	MIPR	Yuma Proving Ground (YPG) : Yuma, AZ	0.383	0.060	Aug 2018	-		-		-		-	Continuing	Continuing	-
FASCAM Study - ARDEC Gator Component Testing	MIPR	ARDEC : Picatinny Arsenal, NJ	0.290	-		-		-		-		-	Continuing	Continuing	-
FASCAM Study - ARDEC Gator Component Testing	MIPR	ARDEC : Picatinny Arsenal, NJ	0.227	-		-		-		-		-	Continuing	Continuing	-
MK3A2 Replacement, XM111, Offensive Hand Grenade	MIPR	Various : Various locations	-	0.031	May 2018	0.028	Apr 2019	0.030	Mar 2020	-		0.030	0.000	0.089	-
MK3A2 Replacement, XM111, Offensive Hand Grenade	MIPR	Batelle : Ohio	-	0.118	Aug 2018	-		-		-		-	0.000	0.118	-
M82 Simulant Smoke Practice Grenade Improved Propellant Retainer	MIPR	ARDEC : Picatinny Arsenal. NJ	-	-		0.297	Jan 2019	-		-		-	Continuing	Continuing	-
		Subtotal	3.701	3.136		2.270		1.192		-		1.192	Continuing	Continuing	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
MK3A2 Replacement, XM111, Offensive Hand Grenade	MIPR	Army Test and Evaluation Command : Aberdeen Proving Grounds, MD	0.626	-		-		-		-		-	Continuing	Continuing	-
MK3A2 Replacement, XM111, Offensive Hand Grenade	MIPR	Redstone Tech Test Center : Redstone Test Center	-	0.037	Apr 2018	-		0.414	Jul 2020	-		0.414	Continuing	Continuing	-
Countermeasure Flare Decoy Formulations	MIPR	Naval Air Warfare Center Aircraft	0.150	0.472		-		-		-		-	Continuing	Continuing	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607131A / *Weapons and Munitions Product Improvement Programs*	Project (Number/Name) ER2 / *Close Combat Technology*	

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		Division : Patuxent River, MD													
MK3A2 Replacement, XM111, Offensive Hand Grenade	MIPR	ATC : Aberdeen Proving Grounds, NJ	0.147	0.204	Apr 2018	-		-		-		-	Continuing	Continuing	-
MK3A2 Replacement, XM111, Offensive Hand Grenade	MIPR	Dugway Proving Grounds : UT	0.024	-		-		-		-		-	Continuing	Continuing	-
MK3A2 Replacement, XM111, Offensive Hand Grenade	MIPR	Yuma Proving Ground : Yuma, AZ	0.116	0.452	Jul 2018	0.137	Mar 2019	-		-		-	Continuing	Continuing	-
MK3A2 Replacement, XM111 Offensive Hand Grenade	MIPR	Public Health Command : MD	0.040	-		-		-		-		-	Continuing	Continuing	-
MK3A2 Replacement, XM111, Offensive Hand Grenade	MIPR	Maneuver Center of Excellence : Ft. Benning, GA	-	0.107	Aug 2018	-		-		-		-	0.000	0.107	-
		Subtotal	1.103	1.272		0.137		0.414		-		0.414	Continuing	Continuing	N/A

	Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	6.619	4.408		3.143		2.056		-		2.056	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER2 / *Close Combat Technology*

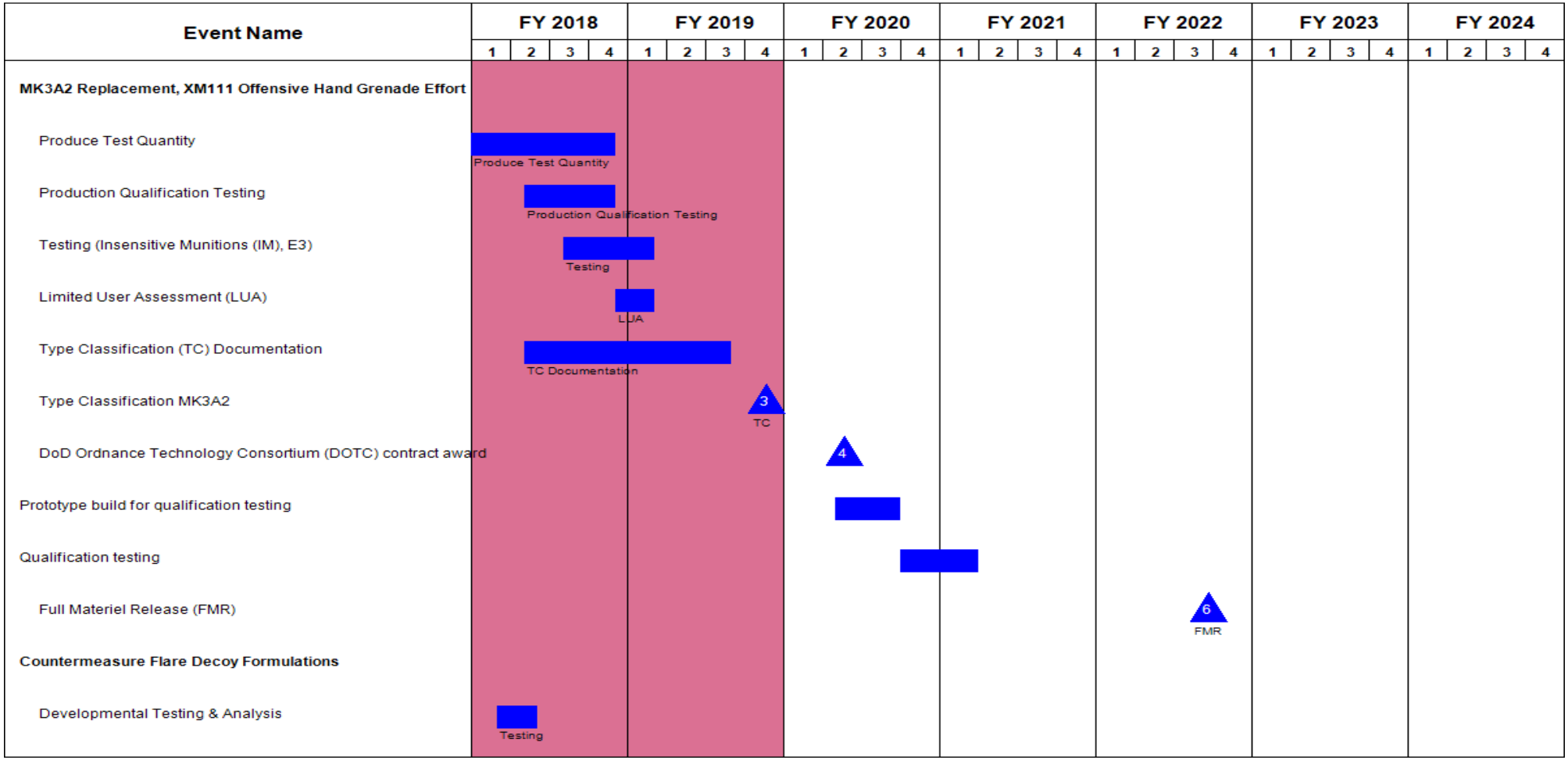

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER2 / *Close Combat Technology*

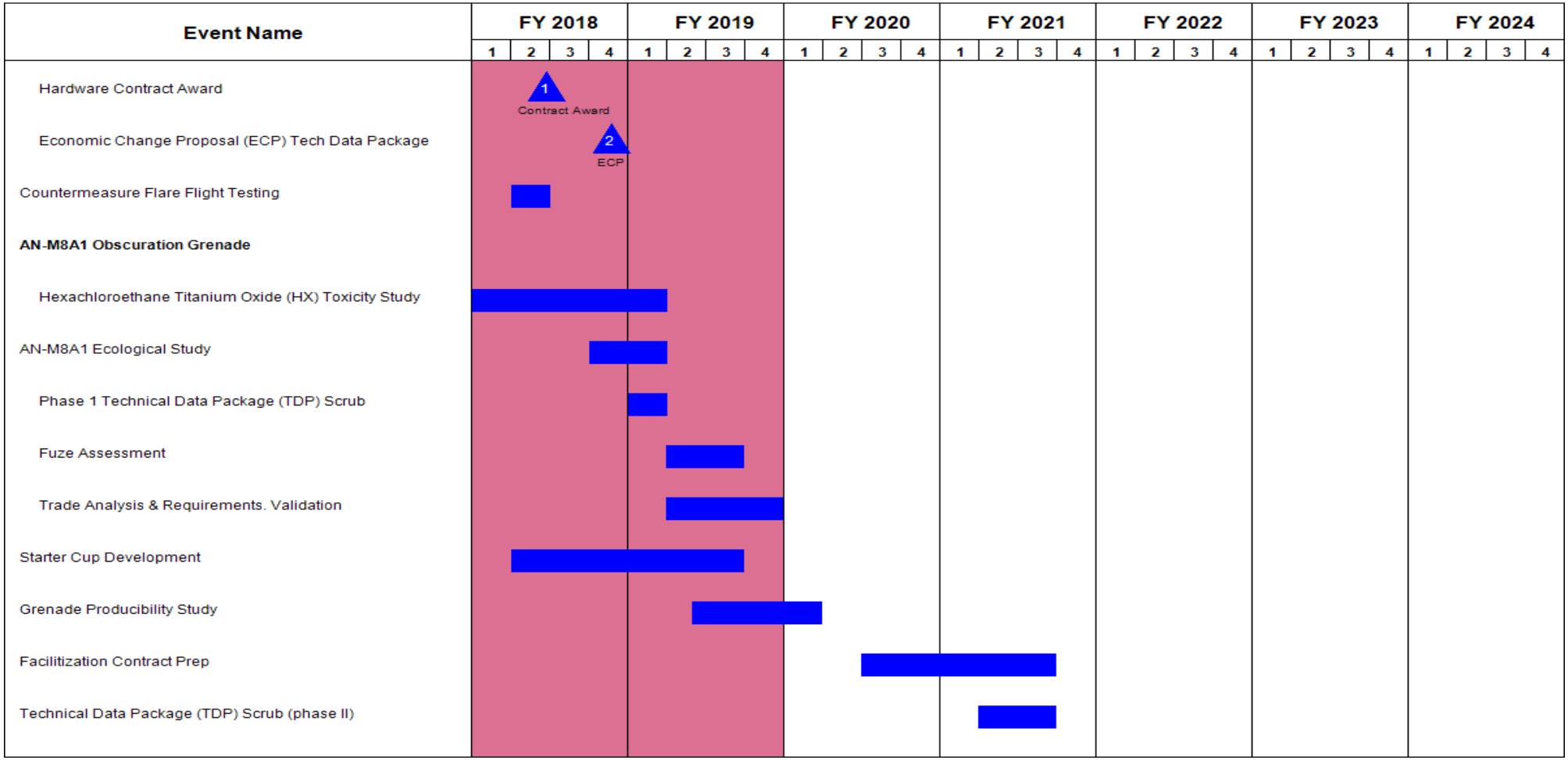

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER2 / *Close Combat Technology*

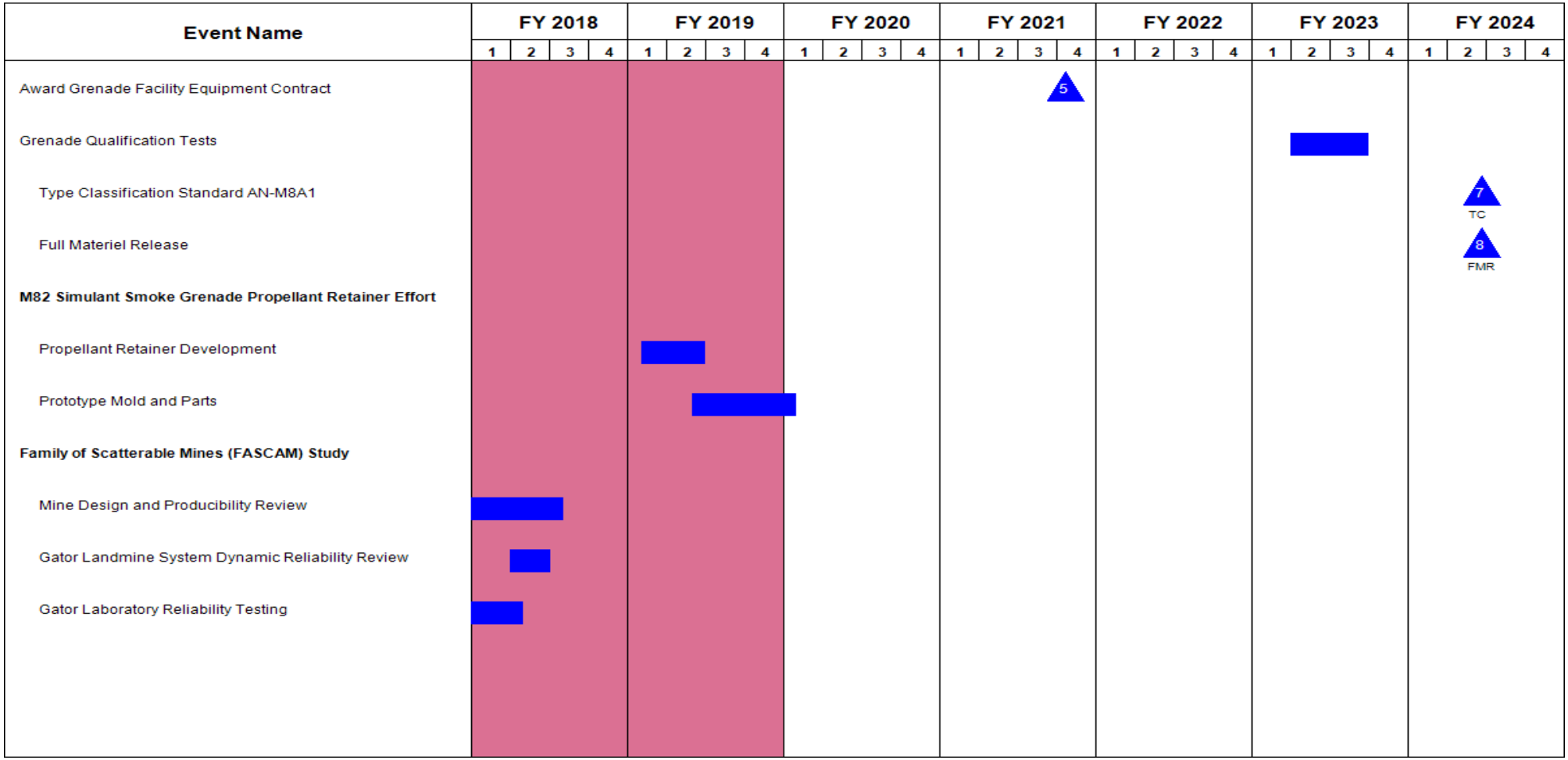

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER2 / *Close Combat Technology*

Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
MK3A2 Replacement, XM111 Offensive Hand Grenade Effort	1	2017	4	2020
Produce Test Quantity	4	2017	4	2018
Production Qualification Testing	2	2018	4	2018
Testing (Insensitive Munitions (IM), E3)	3	2018	1	2019
Limited User Assessment (LUA)	4	2018	1	2019
Type Classification (TC) Documentation	2	2018	3	2019
Type Classification MK3A2	4	2019	4	2019
DoD Ordnance Technology Consortium (DOTC) contract award	2	2020	2	2020
Prototype build for qualification testing	2	2020	3	2020
Qualification testing	4	2020	1	2021
Full Materiel Release (FMR)	3	2022	3	2022
Countermeasure Flare Decoy Formulations	1	2017	4	2020
Developmental Testing & Analysis	1	2017	2	2018
Hardware Contract Award	2	2018	2	2018
Economic Change Proposal (ECP) Tech Data Package	4	2018	4	2018
Countermeasure Flare Flight Testing	2	2018	2	2018
AN-M8A1 Obscuration Grenade	1	2017	4	2020
Hexachloroethane Titanium Oxide (HX) Toxicity Study	1	2017	1	2019
AN-M8A1 Ecological Study	4	2018	1	2019
Phase 1 Technical Data Package (TDP) Scrub	1	2019	1	2019
Fuze Assessment	2	2019	3	2019
Trade Analysis & Requirements. Validation	2	2019	4	2019

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER2 / *Close Combat Technology*

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Starter Cup Development	2	2018	3	2019
Grenade Producibility Study	2	2019	1	2020
Facilitization Contract Prep	3	2020	3	2021
Technical Data Package (TDP) Scrub (phase II)	2	2021	3	2021
Award Grenade Facility Equipment Contract	4	2021	4	2021
Grenade Qualification Tests	2	2023	3	2023
Type Classification Standard AN-M8A1	2	2024	2	2024
Full Materiel Release	2	2024	2	2024
M82 Simulant Smoke Grenade Propellant Retainer Effort	1	2017	4	2020
Propellant Retainer Development	1	2019	2	2019
Prototype Mold and Parts	2	2019	1	2020
Family of Scatterable Mines (FASCAM) Study	3	2017	3	2018
Mine Design and Producibility Review	4	2017	3	2018
Gator Landmine System Dynamic Reliability Review	1	2018	2	2018
Gator Laboratory Reliability Testing	3	2017	1	2018

Note

MK3A2 Replacement, XM111 Offensive Hand Grenade Effort: schedule, with the exception of Full Material Release (FMR), depicts efforts funded via RDT&E Program Element 0607131, Project ER2 line. Efforts, beginning in FY21, are funded with Procurement of Ammunition, Army funding (Standard Study Number E33010) Grenade Hand, Offensive XM111 and are not depicted on this schedule.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army			Date: March 2019
Appropriation/Budget Activity 2040 / 7	R-1 Program Element (Number/Name) PE 0607131A / *Weapons and Munitions Product Improvement Programs*	Project (Number/Name) ER5 / *Indirect Fire and Fuze Technology*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
ER5: *Indirect Fire and Fuze Technology*	-	3.540	2.817	5.064	-	5.064	4.468	2.241	2.308	0.000	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Indirect Fire and Fuze Technology Project includes product improvement development efforts to upgrade indirect fire weapon systems and munitions that have already been fielded and/or are in production. Indirect Fire Weapons and Munitions Product Improvement Projects include improved target engagement, increased reliability, availability, maintainability, and safety, standardization and interoperability with weapons and munitions of Allied Nations, defense exportability features, reduction of failure mechanisms, and supply chain risk through introduction of new and alternative technology and materiel solutions, improvement of manufacturing methods and their associated production and life cycle support processes, new capabilities in response to the evolving and emerging threats and countermeasures, and reduction/elimination of potential environmental and health risks associated with these products.

This Project supports the identification, study, analysis, and development of fuzing technologies and safe arm devices in production and in the field. This Project will implement technologies into fuzing systems to preclude obsolescence, maximize standardization, enhance performance, and improve the safety and exportability of existing munitions. The Project addresses two major areas: (1) analysis and (2) block upgrades. Analysis efforts will identify second sources for fuzing systems that may reduce costs by providing competition, and maintain production when sources or parts are no longer available. It will also allow for the performance enhancement of current ammunition items by conducting studies of major fuze components to detect and identify latent defects. The second major area is block upgrades, which will identify and perform studies on improvements to fuzes, increase commonality of fuze components and requirements. Block upgrades will enable the introduction of the latest technologies into fuzing, keep the fuzing design current to avoid obsolescence issues, and add capabilities. FY 2020 funds will support the engineering tests and evaluations on the prototype replacement electronic transceiver prototypes for indirect fire and direct fire proximity fuzes, will conduct engineering tests on optimized impact switches for use in mortar and medium caliber fuzes that will improve producibility, will conduct engineering tests of the medium caliber fuze safety design modifications, will support the analysis of the prototype low cost electronic safe and arm devices, will support the analysis on the hand grenade fuzes to reduce the number of critical defects that will improve producibility and increase safety, and will conduct evaluations on the next generation microcontroller to replace a one-time programmable component due to part obsolescence for mortar proximity fuzes.

This Project also supports the incorporation of the new Hexachloroethane Titanium Oxide (HX) smoke fill formulation while utilizing the existing illumination shell body configuration to support mortar smoke training for US Army Europe (USAREUR). The HX smoke fill formulation is less toxic and less incendiary than the current Mortar Red Phosphorus (RP) or White Phosphorous (WP) Smoke rounds and will reduce risk of unintended collateral damage or environmentally hazardous waste. USAREUR has yearly requirements for procurement of smoke mortar cartridges across all calibers to be used for training, but is prohibited from training with the current WP or RP smoke munitions in Europe due to environmental restrictions. FY 2020 funds support qualification of HX smoke fill formulation into the 81mm smoke family of ammunitions. Engineering efforts will identify the formulation percentage of constituents and identify the production processes required to promote effective smoke production that is less toxic and ultimately provides effective smoke screening and burn time performance.

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This Project also supports artillery and mortar conventional ammunition enhancements to lethality, effectiveness, survivability, accuracy and general product improvements. FY 2020 funding will support reliability improvements and increased range within current fielded Artillery and Mortar Conventional Ammunition.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: Fuze Technology Improvements (FTI)	1.787	2.727	2.196	-	2.196
Description: This project implements new, mature, technologies into fuzing systems to preclude obsolescence, maximize standardization, enhance performance, and improve the safety and exportability of existing munitions. The Fuze Technology Improvements (FTI) project addresses two major areas: (1) analysis and (2) block upgrades. Analysis efforts will identify second sources for fuzing systems that may reduce costs by providing competition, and maintain production when sources or parts are no longer available. It will also allow for the performance enhancement of current ammunition items by conducting studies of major fuze components to detect and identify latent defects. The second major area is block upgrades, which will identify and perform studies on improvements to fuzes, increase commonality of fuze components and requirements. Block upgrades will enable the introduction of the latest technologies into fuzing, keep the fuzing design current to avoid obsolescence issues, and add capabilities. ***FY 2019 Plans:*** Block Upgrades: Conduct modeling and simulation on medium caliber Safe and Arm (S&A) design modifications, evaluate medium caliber prototype modifications against performance requirements, conduct studies on hand grenade fuze to reduce the number of critical defects that will improve producibility and increase safety, conduct studies on artillery fuze electronic safe and arm designs for low cost Safe and Arm performance enhancements. Analysis / Risk Mitigation: Conduct engineering tests to prove-out electronic transceiver replacement prototypes for indirect fire and direct fire proximity fuzes, evaluate optimized impact switch prototypes, conduct studies on mortar fuze design architecture with the latest fuze safety guidelines to preclude component obsolescence. ***FY 2020 Base Plans:*** Block Upgrades: Will conduct engineering tests of the medium caliber fuze safety design modifications, will conduct analysis of the prototype low cost electronic safe and arm devices, will conduct on analysis on the hand grenade fuzes to reduce the number of critical defects that will improve producibility and increase safety, and will conduct studies on power sources for increased producibility and higher throughput. Analysis / Risk Mitigation: Will support the engineering tests and evaluations on the prototype replacement electronic transceiver prototypes for indirect fire and direct fire proximity fuzes, will conduct engineering tests on the optimized impact switches for use in mortar and medium caliber fuzes, and will conduct evaluations on the					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
next generation microcontroller to replace a one time programmable component due to part obsolescence for mortar proximity fuzes. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease in funding from FY 2019 to FY 2020 due to past FTI tasks that have been executed and successfully transitioned into production efforts.					
Title: Mortar Smoke Development ***Description:*** The initial phase of this project will focus on validating smoke canister and mortar cartridge designs for the 120mm caliber culminating in a technology demonstration. Qualification, and safety testing will follow to work towards a full Type Classification. The second and third phase of this project will identify similar solutions for the 81mm and 60mm caliber respectively. ***FY 2020 Base Plans:*** Phase 1 - 120mm qualification and safety testing will follow to work towards a full Type Classification. Phase 2 - 81mm caliber design qualification: Activities will focus on engineering efforts to identify the formulation percentage of constants that provides effective smoke screening and burn time performance. Analysis of results for smoke performance will be conducted to identify the production processes required to provide consistent results during both mixing and pressing operations. Engineering efforts will focus on development of a smoke canister design that will promote effective smoke production and screening while being adapted to existing mortar cartridge carrier designs. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The FY 2020 effort is tied to 81mm Mortar caliber design qualification with Hexachloroethane Titanium Oxide (HX) Smoke and coincides with the continuation of the 2018 and 2019 efforts.	1.322	-	1.668	-	1.668
Title: 81mm M821A3E1 HE IM Mortar Program ***Description:*** Activities include the maturation of the lethality through modeling and simulation as well as testing to ensure the 81mm will meet all user requirements. Activities also include ballistic testing to ensure safe and effective firing of the 81mm Mortar. This will also include modeling to ensure the contour of the round will ensures stable interior and exterior ballistics. Activities will also focus on maturation of the manufacturability of the round to ensure unit cost is as low as possible, this will be executed through loading studies and other Design of Experiments (DOE).	0.431	-	-	-	-
Title: Conventional Ammunition Range and Reliability Improvements	-	-	1.200	-	1.200

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Description: This project explores possibilities of increasing range, enhancing reliability, and increasing performance of Artillery and Mortar ammunition through multiple avenues. Conventional Ammunition Range and Reliability Improvements project will conduct analysis efforts to identify improvement areas to key parameters through modeling and simulation. ***FY 2020 Base Plans:*** Studies and analysis (Key Parameter Development and Management (KPDM) and Model Based Systems Engineering (MBSE)) will be conducted. The outcomes of these activities will identify areas of possible improvement. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increase in FY 2020 required for enhancement studies and analysis on Mortar and Artillery ammunition. Studies and analysis conducted will aim to increase performance through modeling and simulation.					
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:*** FY 2019 SBIR / STTR Transfer ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2019 SBIR / STTR Transfer	-	0.090	-	-	-
Accomplishments/Planned Programs Subtotals	3.540	2.817	5.064	-	5.064

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

Fuze Technology Improvements (FTI) will improve current production munitions by exploiting existing fuzing technologies and inserting them into current fielded and/or production fuzes, providing safer, more producible, and more lethal fuzing solutions. FTI develops second source suppliers and resolves component obsolescence issues to mitigate risk and prevent production interruptions in order to continue to provide safer, more reliable munitions for the Warfighter with significant risk reduction to production fuzes also benefiting the U.S. Taxpayer. The effort is a continuation of studies, analysis, evaluations, and development of fuzing technologies and safe and arm devices in production and in the field. This program will implement these technologies into fuzing systems to preclude component obsolescence, maximize standardization, enhance performance, and improve the safety and exportability of existing munitions. The Fuze Technology Integration Program utilizes both the DoD

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Ordnance Technology Consortium (DOTC) Other Transaction Agreement (OTA) to produce prototypes of the fuze technologies and devices, and Federal Acquisition Regulation (FAR) based contracts to implement proven efforts into production fuzes.

The Hexachloroethane Titanium Oxide (HX) smoke mortar cartridge project will use existing production process and technologies at Government Owned Government Operated (GOGO) facilities that currently produce 60mm/81mm/120mm smoke and illumination munitions. Crane Army Ammunition Activity (CAAA) Pyro will be responsible for mixing and pressing HX smoke compositions for all testing and development, and CAAA fabrication shop will produce smoke canisters. Pine Bluff Arsenal (PBA) will conduct body load and Load Assemble and Pack (LAP) of all cartridge test samples for qualification and validation testing. All other components will use standard parts currently in inventory or can be purchased through existing component contracts.

E. Performance Metrics

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army			Date: March 2019
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Management Services ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Management Support	Various	Office of the Project Manager (PM) Combat Ammunition Systems (CAS) : Picatinny Arsenal, NJ	-	-		-		0.005	Oct 2019	-		0.005	0.000	0.005	-
		Subtotal	-	-		-		0.005		-		0.005	0.000	0.005	N/A

Remarks

Program Management support includes travel and documentation support.

Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
40mm Fuze Improvements	SS/FFP	AMTEC Corporation : Janesville, WI	-	0.234	Feb 2018	-		-		-		-	0.000	0.234	0.100
Fuze Technology Development	MIPR	DoD Ordnance Technology Consortium (DOTC) : Various	0.352	0.946	Oct 2017	1.662	Oct 2018	1.000	Oct 2019	-		1.000	0.000	3.960	-
Mortar Smoke Development	MIPR	Government Owned Government Operated (GOGO) Facilities : Various	-	0.357	Oct 2018	-		0.800	Feb 2020	-		0.800	0.000	1.157	-
81mm M821A3E1 HE IM Mortar Prototyping	MIPR	DoD Ordnance Technology Consortium (DOTC) : Various	1.040	-		-		-		-		-	0.000	1.040	-
Conventional Ammunition Range and Lethality Improvements	MIPR	DoD Ordnance Technology Consortium (DOTC) : Various	-	-		-		0.840	Oct 2019	-		0.840	0.000	0.840	-

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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FY 2019 SBIR / STTR Transfer	TBD	TBD : TBD	-	-		0.090		-		-		-	0.000	0.090	-
		Subtotal	1.392	1.537		1.752		2.640		-		2.640	0.000	7.321	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Fuze Technology Integration Engineering Support	MIPR	Armament Research, Development and Engineering Center (ARDEC) : Picatinny Arsenal, NJ	1.609	0.608	Oct 2017	1.065	Oct 2018	1.096	Oct 2019	-		1.096	0.000	4.378	-
Mortar Smoke Development	MIPR	Armament Research, Development and Engineering Center (ARDEC) : Picatinny Arsenal, NJ	-	0.553	Aug 2018	-		0.275	Oct 2019	-		0.275	0.000	0.828	-
Mortar Smoke Development	MIPR	Edgewood Chemical Biological Center (ECBC) : Army Research LAboratory, MD	-	0.212	Aug 2018	-		0.170	Oct 2019	-		0.170	0.000	0.382	-
M821A3E1 Engineering Support	MIPR	Armament Research, Development and Engineering Center (ARDEC) : Picatinny Arsenal, NJ	0.491	-		-		-		-		-	0.000	0.491	-
M821A3E1 Engineering Support	MIPR	Army Research Lab (ARL) : Adelphi, MD	-	0.024	Jul 2018	-		-		-		-	0.000	0.024	-
Conventional Ammunition Range and Lethality Improvements	MIPR	Armament Research, Development and Engineering Center	-	-		-		0.355	Oct 2019	-		0.355	0.000	0.355	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army			Date: March 2019
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Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
		(ARDEC) : Picatinny Arsenal, NJ													
		Subtotal	2.100	1.397		1.065		1.896		-		1.896	0.000	6.458	N/A

Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
FTI Ballistic Testing	MIPR	Army Test and Evaluation Command (ATEC) : Yuma Proving Ground, AZ	0.100	-		-		0.100	Mar 2020	-		0.100	0.000	0.200	-
Mortar Smoke Develeopment	MIPR	Army Test and Evaluation Command (ATEC) : Yuma Proving Ground, AZ	-	0.199	Aug 2018	-		0.423	Feb 2020	-		0.423	0.000	0.622	-
M821A3E1 Full Arena Testing and Analysis	MIPR	Army Research Lab : Aberdeen Proving Ground, MD	-	0.407	May 2018	-		-		-		-	0.000	0.407	-
M821A3E1 HE IM Mortar Testing	MIPR	Army Test and Evaluation Command (ATEC) : Yuma Proving Ground, AZ	0.369	-		-		-		-		-	0.000	0.369	-
		Subtotal	0.469	0.606		-		0.523		-		0.523	0.000	1.598	N/A

	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	3.961	3.540		2.817		5.064		-		5.064	0.000	15.382	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Army		Date: March 2019
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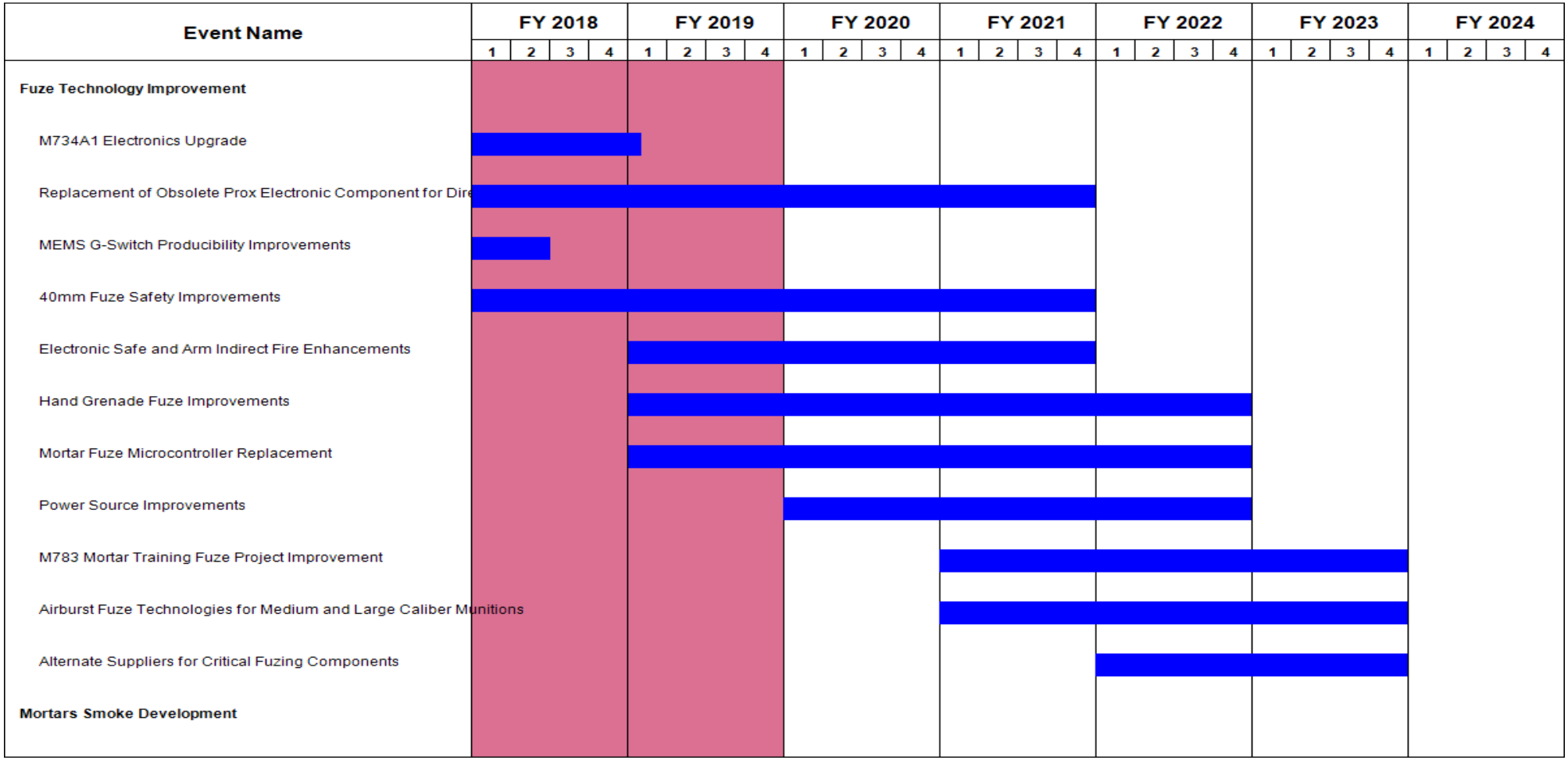

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Army		Date: March 2019
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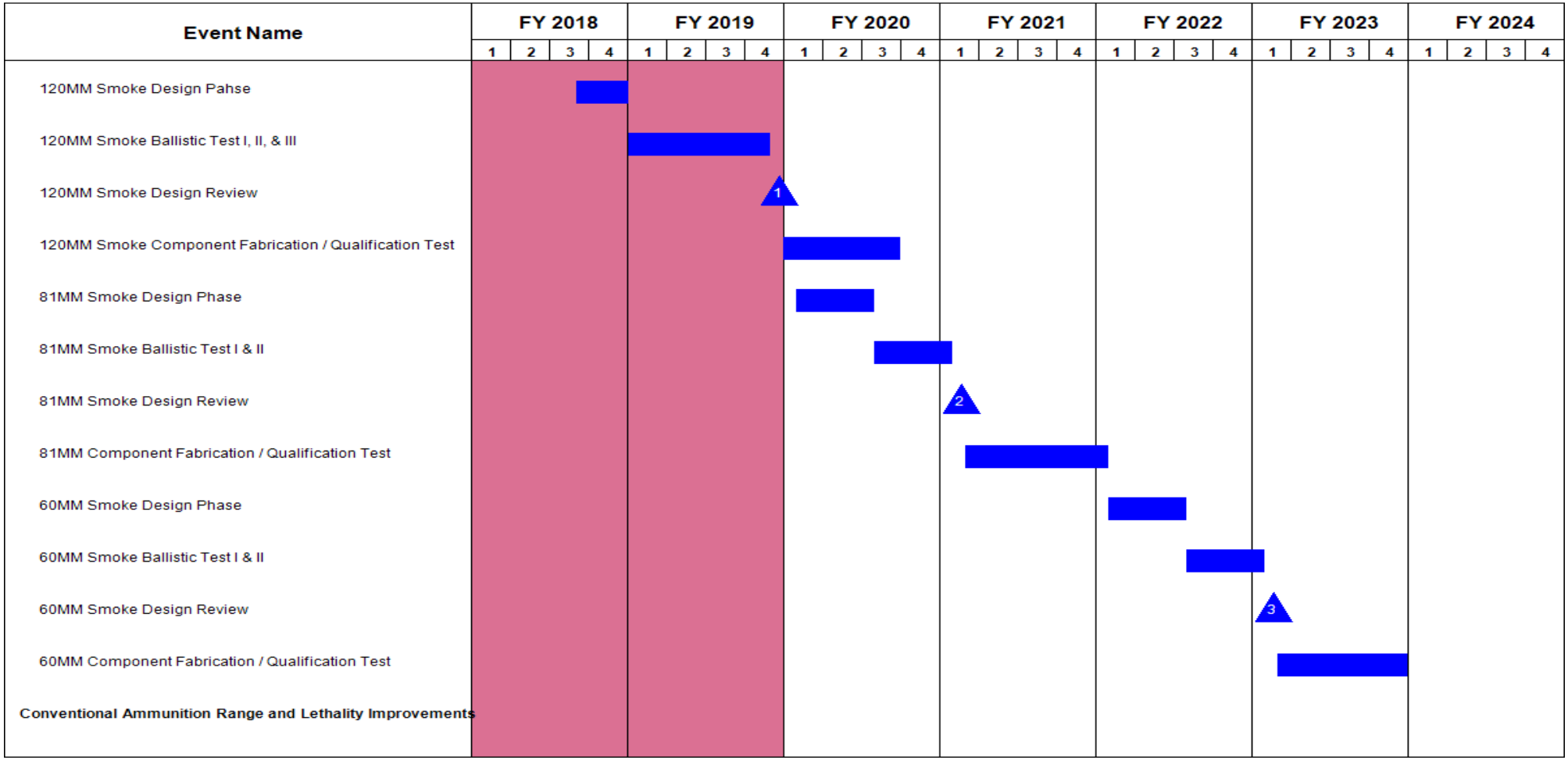

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Army		Date: March 2019
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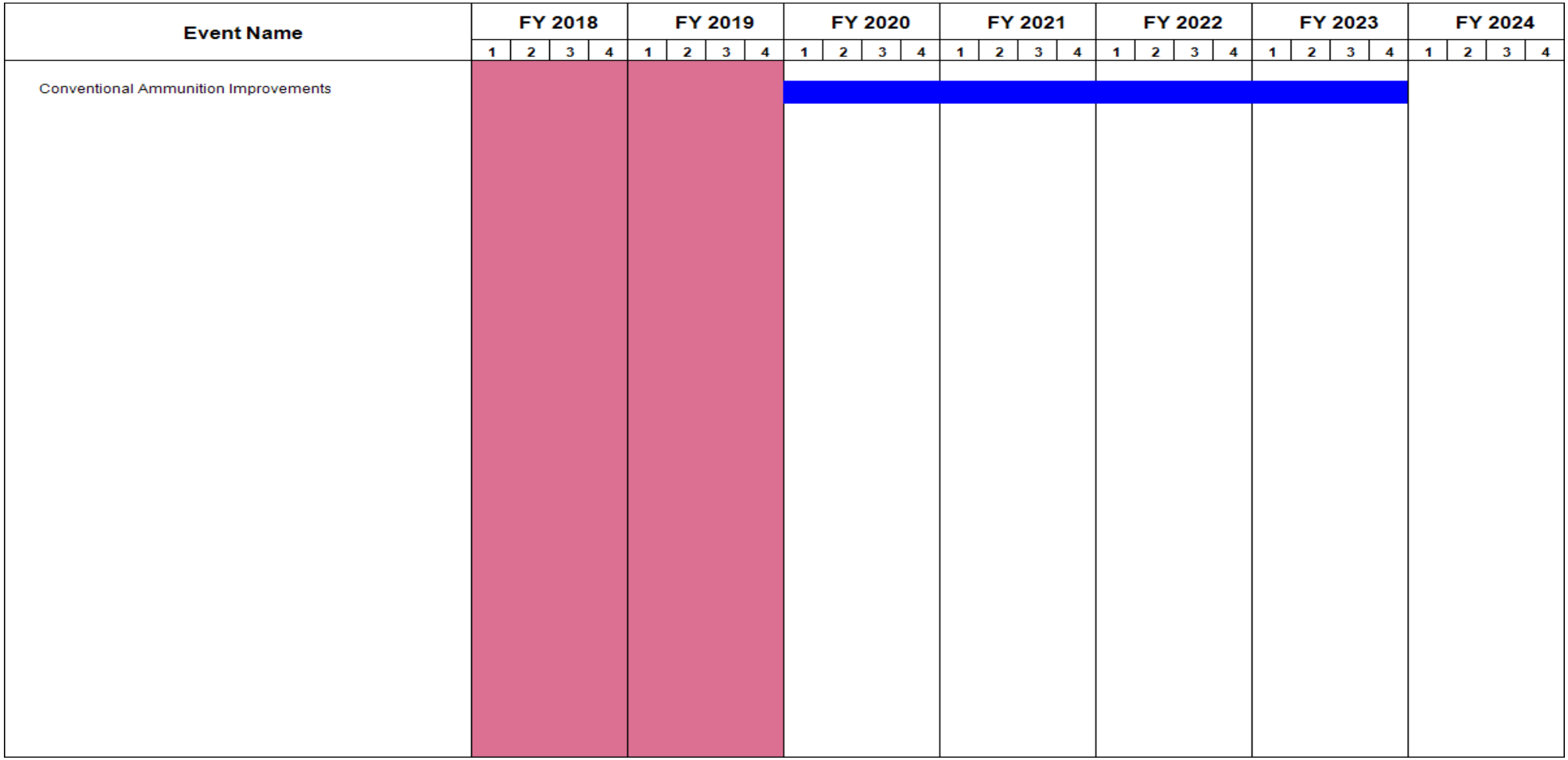

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Army		Date: March 2019
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Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
Fuze Technology Improvement	1	2016	4	2023
M734A1 Electronics Upgrade	1	2016	1	2019
Replacement of Obsolete Prox Electronic Component for Direct/Indirect Fire Fuzes	1	2017	4	2021
MEMS G-Switch Producibility Improvements	1	2018	2	2018
40mm Fuze Safety Improvements	1	2018	4	2021
Electronic Safe and Arm Indirect Fire Enhancements	1	2019	4	2021
Hand Grenade Fuze Improvements	1	2019	4	2022
Mortar Fuze Microcontroller Replacement	1	2019	4	2022
Power Source Improvements	1	2020	4	2022
M783 Mortar Training Fuze Project Improvement	1	2021	4	2023
Airburst Fuze Technologies for Medium and Large Caliber Munitions	1	2021	4	2023
Alternate Suppliers for Critical Fuzing Components	1	2022	4	2023
Mortars Smoke Development	1	2020	4	2023
120MM Smoke Design Pahse	3	2018	4	2018
120MM Smoke Ballistic Test I, II, & III	1	2019	4	2019
120MM Smoke Design Review	4	2019	4	2019
120MM Smoke Component Fabrication / Qualification Test	1	2020	3	2020
81MM Smoke Design Phase	1	2020	3	2020
81MM Smoke Ballistic Test I & II	3	2020	1	2021
81MM Smoke Design Review	1	2021	1	2021
81MM Component Fabrication / Qualification Test	1	2021	1	2022
60MM Smoke Design Phase	1	2022	3	2022

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Army		Date: March 2019
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	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
60MM Smoke Ballistic Test I & II	3	2022	1	2023
60MM Smoke Design Review	1	2023	1	2023
60MM Component Fabrication / Qualification Test	1	2023	4	2023
Conventional Ammunition Range and Lethality Improvements	1	2020	4	2023
Conventional Ammunition Improvements	1	2020	4	2023

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COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
ER6: *Direct Fire Technology*	-	8.354	12.591	8.525	-	8.525	5.729	6.592	6.413	2.989	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

A. Mission Description and Budget Item Justification

The Direct Fire Technology funding will be used to support direct fire ammunition from small caliber ammunition, 40mm grenade, medium caliber cannon ammunition and large caliber ammunition enhancements to lethality, effectiveness, survivability, accuracy and general product improvements. FY 2020 funds are used for a more lethal and safer design for 40mm grenades that will be built and tested. Warhead improvement and primer improvement for 30mm ammunition are also under development. A number of improvements for training ammunition, environmentally friendly primers, and lightweight small caliber ammunition will continue to be developed. Potential improvements to 105mm and 120mm ammunition will be examined.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: Lightweight Ammunition	-	0.250	3.700	-	3.700
Description: Develop, demonstrate, and qualify a Lightweight Small Caliber Ammunition (LSCA) 7.62mm, 5.56mm, .50 caliber and other caliber capability that will provide an ammunition weight savings of ten to fifty percent to the M2, M240, M4A1, and M249 gunner, assistant gunner, and ammo bearer. ***FY 2019 Plans:*** Phase II contractor will continue to develop 7.62mm preliminary lightweight cartridge design. The government will conduct Pre-Validation Testing (PVT) and a Limited User Evaluation (LUE) prior to down-selecting to a single contractor for Phase III award. Initial designs for .50 caliber lightweight cartridges will also be investigated. ***FY 2020 Base Plans:*** The Government will down-select to a single contractor and 7.62mm concept before entering into Phase III. Phase III contractor will continue to optimize their 7.62mm lightweight cartridge design ahead of Validation Testing (VT) and Limited User Evaluation (LUE). Multiple contracts will be awarded to develop a Lightweight .50 caliber design ahead of down-selecting to a single design. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Continued development of 7.62mm and .50 caliber lightweight ammunition.					
Title: Lead Free Primer	2.000	1.705	1.700	-	1.700
Description: Automate and integrate environment friendly lead free primary explosives within the small caliber family of ammunition. Addresses health concerns of lead intake during firing by removing lead styphnate from					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
small caliber primers. Automated pilot line combined with new mix reduces human exposure, improves quality, improves safety and reduces environmental waste in manufacturing process. ***FY 2019 Plans:*** FY 2019 funding will provide the ability to conduct primer qualification testing on 5.56mm primer and complete the build for the 7.62mm primer qualification. The program will continue to work through the transition of the automated primer manufacturing process to Lake City Army Ammunition Plant (LCAAP), as well as refinement and optimization of the automated process. ***FY 2020 Base Plans:*** FY 2020 funding will provide the ability to complete 5.56mm green primer Production Qualification Testing (PQT), complete the build and test in support of Pre-Production Qualification Testing (PPQT) for 7.62mm green primer ammunition, and begin the build for .50 Caliber PPQT. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increase in funding to support 5.56mm PQT and 7.62mm PPQT.					
Title: Support Sniper Ammunition Integration Into Army Standard Sniper Weapons ***Description:*** Modify existing sniper ammunition to support integration into new Army standard sniper weapons. Maintain compatibility with legacy sniper weapons while improving operational availability. ***FY 2019 Plans:*** FY 2019 work will develop and evaluate sniper ammunition improvements. ***FY 2020 Base Plans:*** FY 2020 work will continue to test and evaluate sniper ammunition improvements. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decreased funding due decreased testing requirements in FY 2020.	-	0.500	0.100	-	0.100
Title: Support Improvements in Direct Fire Propulsion Systems ***Description:*** Improve Direct Fire Propulsion Systems to increase user survivability. ***FY 2019 Plans:*** FY 2019 work will explore additional sources of supply in the National Technology and Industrial Base (NTIB) and pursue improvements to address temperature sensitivities of energetics and primer ballistics. Efforts will	-	0.500	0.100	-	0.100

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
also be made to continue to explore technology improvements to reduce muzzle flash and increase precision by reducing dispersion of the M80A1, M118LR, and other sniper compatible ammunition. ***FY 2020 Base Plans:*** FY 2020 work will continue to pursue improvements to address temperature sensitivities of energetics and primer ballistics. Efforts will also be made to continue to explore technology improvements to reduce muzzle flash and increase precision by reducing dispersion of the M80A1, M118LR, and other sniper compatible ammunition. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decreased funding due to a decrease in studies on direct fire systems.					
Title: Improved M789 Lethality, Warhead Fragmentation Improvement ***Description:*** Improve 30mm M789 warhead lethality by performing trade studies and implementing advanced warhead and fuze technologies to promote more efficient fragmentation. ***FY 2019 Plans:*** FY 2019 work will continue to support the down-select to a single decision and preparing for manufacturability and qualification build. Funding will also support the initial build to be used to for qualification testing. ***FY 2020 Base Plans:*** FY 2020 work will continue to support all necessary updates to the technical data package (TDP) for M789 ammunition. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease due to testing completion in FY 2019.	1.307	2.520	0.250	-	0.250
Title: M433 Warhead Improvement ***Description:*** 40mm: Improve lethality (fragmentation) of the M433 grenade. ***FY 2019 Plans:*** FY 2019 work will complete engineering change proposals (ECP) and technical data package (TDP) actions. FY 2019 work will complete qualification testing. ***FY 2019 to FY 2020 Increase/Decrease Statement:***	1.594	1.000	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Decrease due to completion of enhancement effort with FY 2019 funding.					
Title: 20mm C-RAM Ammo Improvement ***Description:*** As per Joint Urgent Operational Needs Statement (JUONS) CC-0562 for enhanced lethality, M940 20mm ammunition requires research and development efforts to increase the lethality effects of the Land-based Phalanx Weapon System (LPWS) against larger rocket threats. This effort will increase the current capability of the M940 by incorporating design features to provide improvement to probability of Kill. This effort will also evaluate the effects the new ammunition has on the weapon system barrel wear. ***FY 2019 Plans:*** FY 2019 funding will continue to support the design and development of an optimized M940 concept to achieve enhanced lethality and an improved probability of kill. ***FY 2020 Base Plans:*** FY 2020 funding will continue to support the design and development of an optimized M940 concept and conduct studies and testing to improve barrel wear. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease due to reduced efforts required for M940 improvements.	0.580	0.500	0.150	-	0.150
Title: 30mm Ammunition Improvement ***Description:*** Increase anti-personnel lethality and lethality within Military Operations in an Urban Terrain (MOUT) structures compared to current Army medium caliber solutions.	0.900	-	-	-	-
Title: Tank Ammunition Improvements ***Description:*** Develop and test potential improvements to 105mm and 120mm gun system ammunition. ***FY 2019 Plans:*** FY 2019 work will continue to support various efforts for 105mm and 120mm tank ammunition, including tracer improvements, combustible cartridge case design and fabrication improvements, and cartridge testing for the M68 cannon. ***FY 2020 Base Plans:*** FY 2020 work will continue to support various efforts for 105mm and 120mm tank ammunition, including tracer improvements, combustible cartridge case design and fabrication improvements, and cartridge testing for the	1.450	0.500	0.250	-	0.250

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
M68 cannon. Additionally, initial feasibility studies and developmental efforts will explore a 105mm Advanced Multipurpose (AMP) cartridge. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease due to reduced technology development.					
Title: 40mm M576 Improvement Study ***Description:*** 40mm M576 product improvement will provide the warfighter with the ability to quickly defeat closed-in personnel targets ***FY 2019 Plans:*** FY 2019 funding will be used to baseline the current performance and examine improved candidate designs. ***FY 2020 Base Plans:*** FY 2020 funding will continue exploration of improved candidate designs.	-	0.200	0.200	-	0.200
Title: Single Crystal Tungsten Evaluation ***Description:*** Testing will be conducted to determine the effectiveness of single crystal tungsten penetrators against armored targets. ***FY 2019 Plans:*** FY 2019 work will continue to include testing to determine the effectiveness of single crystal tungsten penetrators against armored targets. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease due to completion of testing.	0.523	0.250	-	-	-
Title: M550 Fuze Improvement ***Description:*** Replace 40mm M550 single stage fuze with a dual spinlock fuze to improve safety and performance reliability. ***FY 2019 Plans:*** FY 2019 funding will be used to acquire and study M550 fuzes and materials in order to support the new fuze build and FY 2020 testing events. ***FY 2020 Base Plans:***	-	1.250	0.500	-	0.500

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
FY 2020 funding will be used to complete and build the quantity required to support qualification testing planned for FY 2021. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increase in funding for quantity to support qualification testing.					
Title: Caliber .50 Improvement ***Description:*** Explore options for improvement to current legacy .50 caliber ammunition in response to the .50 caliber Munitions Capabilities Development Document (CDD). ***FY 2019 Plans:*** FY 2019 funding will support the exploration of improvements to various .50 caliber munitions to include the M903 and M962 rounds. ***FY 2020 Base Plans:*** FY 2020 funding will support Design Verification Test (DVT) 1 and DVT 2 of enhanced M903, M962, and other .50 caliber rounds as per required in the .50 Caliber Munitions CDD.	-	0.500	0.500	-	0.500
Title: Operation Inherent Resolve for ISIL - JUONS CC-0562 M940 Ammunition ***Description:*** FY 2019 Overseas Contingency Operations request includes $2.548 Million for a Joint Urgent Operational Needs Statement for M940 ammunition. ***FY 2019 Plans:*** Continue improvements to M940 ammunition, perform design modifications, and build and test new ammunition. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Decrease due to satisfying JUONS by FY 2019.	-	2.548	-	-	-
Title: 40mm Airburst Training ***Description:*** Conduct studies and explore options to satisfy 40mm airburst training requirements. ***FY 2020 Base Plans:*** Conduct study and explore options that will satisfy 40mm airburst training requirements. ***FY 2019 to FY 2020 Increase/Decrease Statement:***	-	-	0.100	-	0.100

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Increase due to new study on 40mm airburst training round.					
Title: 7.62mm Dispersion Improvement ***Description:*** Explore options for dispersion improvement to 7.62mm ammunition, specifically the XM1158 and M80A1, to provide increased lethality to the warfighter. ***FY 2020 Base Plans:*** FY 2020 funding will begin exploration into 7.62mm dispersion improvement methods to provide increased lethality to the warfighter. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** Increase due to studies on improving small caliber dispersion.	-	-	0.300	-	0.300
Title: Handgun Ammunition Enhancements ***Description:*** Modify existing handgun ammunition to increase battlefield effectiveness beyond current capabilities. ***FY 2020 Base Plans:*** FY 2020 activities will include testing and evaluating new handgun ammunition improvements. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 increase due to the initial testing and evaluation of handgun ammunition improvements.	-	-	0.150	-	0.150
Title: Grenade Rifle Entry Munition (GREM) Improvements ***Description:*** Explore improvements to the Grenade Rifle Entry Munition (GREM) in order to increase performance and reliability and reduce costs. ***FY 2020 Base Plans:*** Conduct studies and perform preliminary tests to increase the performance and reliability of the Grenade Rifle Entry Munition (GREM) system. ***FY 2019 to FY 2020 Increase/Decrease Statement:*** FY 2020 will begin exploring options for Grenade Rifle Entry Munition improvements.	-	-	0.525	-	0.525
Title: FY 2019 SBIR / STTR Transfer ***FY 2019 Plans:***	-	0.368	-	-	-

Exhibit R-2A, RDT&E Project Justification: PB 2020 Army		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
FY 2019 SBIR / STTR Transfer					
FY 2019 to FY 2020 Increase/Decrease Statement: FY 2019 SBIR / STTR Transfer					
Accomplishments/Planned Programs Subtotals	8.354	12.591	8.525	-	8.525

C. Other Program Funding Summary ($ in Millions)

Line Item	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
• EL8: *LIGHTWEIGHT CARTRIDGE CASE FOR SMALL CALIBER*	2.870	-	0.000	-	0.000	-	-	-	-	0.000	2.870

Remarks

D. Acquisition Strategy

The acquisition strategy is that all contracts will be full and open competition firm fixed price.

E. Performance Metrics

N/A

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army			Date: March 2019
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Program Manager Maneuver Ammunition Systems (PM MAS) - Labor & Travel	Various	Picatinny Arsenal : NJ	0.109	-		-		-		-		-	0.000	0.109	-
M433 Warhead Improvement - Contract 1	C/FFP	Polymer Technologies Incorporated : Newark, DE	0.171	-		-		-		-		-	0.000	0.171	-
M433 Warhead Improvement - Contract 2	C/IDIQ	Amtec Corporation : Huntsville, AL	0.134	-		-		-		-		-	0.000	0.134	-
M433 Warhead Improvement - Contract 3	C/FFP	Amtec Corporation : Huntsville, AL	2.275	-		-		-		-		-	0.000	2.275	-
M789 Enhanced Lethality - Contract 1	C/FFP	General Dynamics : Marion, VA	-	0.208	Oct 2017	0.850	Dec 2018	-		-		-	0.000	1.058	-
M789 Enhanced Lethality - Contract 2	TBD	CLogic Defense : Ponte Vedra Beach, Florida	-	0.700	Mar 2018	0.500	Jan 2019	0.800	Oct 2019	-		0.800	0.000	2.000	-
Lightweight Ammunition - Contract 1	C/FFP	TBD : TBD	-	-		-		2.000	Jan 2020	-		2.000	Continuing	Continuing	Continuing
Lightweight Ammunition - Contract 2	TBD	TBD : TBD	-	-		-		1.500	Jan 2020	-		1.500	Continuing	Continuing	Continuing
Green Primer - Contract 1	C/FFP	Innovative Materials & Processes (IMP), LLC : Rapid City, SD	0.971	-		0.135	Feb 2019	-		-		-	0.000	1.106	-
Green Primer - Contract 2	C/FFP	Alion Science and Technology Corporation : McLean, VA	0.038	-		-		-		-		-	0.000	0.038	-
Green Primer - Contract 3	C/FFP	Orbital - ATK : Independence, MO	0.750	-		0.361	Jan 2019	1.500	Nov 2019	-		1.500	0.000	2.611	-
Green Primer - Contract 4	C/FFP	Frankilin Engineering Group : Nashville, TN	0.170	-		-		0.500	Oct 2019	-		0.500	0.000	0.670	-

Exhibit R-3, RDT&E Project Cost Analysis: PB 2020 Army			Date: March 2019
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Product Development ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
M940 Enhancement - Contract 1	C/FFP	General Dynamics Ordnance and Tactical Systems : Marion, VA	0.231	-		-		-		-		-	0.000	0.231	-
M940 Enhancement - Contract 2	C/FFP	MATSYS : Sterling, VA	0.168	-		-		-		-		-	0.000	0.168	-
JUONS CC-0562 M940 Ammunition - Contract 1	C/FFP	TBD : TBD	-	-		2.548	Jan 2019	-		-		-	0.000	2.548	-
M865 Cartridge Case Development - Contract 1	C/CPFF	Polymer Processing Institute : Newark, NJ	-	0.358	Oct 2017	-		-		-		-	0.000	0.358	-
Single Crystal Tungsten Penetrators - Contract 1	C/CPFF	Savit Corporation : Rockaway, NJ	-	0.042		-		-		-		-	0.000	0.042	-
M550 Fuze Development - Contract 1	TBD	TBD : TBD	-	-		0.214	Jan 2019	-		-		-	0.000	0.214	-
FY 2019 SBIR / STTR Transfer	TBD	TBD : TBD	-	-		0.368		-		-		-	0.000	0.368	-
		Subtotal	5.017	1.308		4.976		6.300		-		6.300	Continuing	Continuing	N/A

Support ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Armament Research Development and Engineering Center (ARDEC)	MIPR	ARDEC : Picatinny Arsenal, NJ	5.063	5.500	Oct 2017	5.350	Nov 2018	1.575	Nov 2019	-		1.575	Continuing	Continuing	Continuing
		Subtotal	5.063	5.500		5.350		1.575		-		1.575	Continuing	Continuing	N/A

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Test and Evaluation ($ in Millions)

Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	FY 2018 Cost	FY 2018 Award Date	FY 2019 Cost	FY 2019 Award Date	FY 2020 Base Cost	FY 2020 Base Award Date	FY 2020 OCO Cost	FY 2020 OCO Award Date	FY 2020 Total Cost	Cost To Complete	Total Cost	Target Value of Contract
Army Research Lab (ARL)	MIPR	Army Research Lab (ARL) : Aberdeen, MD	0.215	0.230	Dec 2017	0.400	Jan 2019	0.200	Jan 2020	-		0.200	Continuing	Continuing	Continuing
Aberdeen Test Center (ATC)	MIPR	Aberdeen Test Center (ATC) : Aberdeen, MD	0.036	1.316	Jun 2018	1.865		0.450	Jan 2020	-		0.450	Continuing	Continuing	Continuing
Redstone Arsenal	MIPR	Redstone Arsenal : Redstone Arsenal, AL	3.256	-		-		-		-		-	0.000	3.256	-
		Subtotal	3.507	1.546		2.265		0.650		-		0.650	Continuing	Continuing	N/A

	Prior Years	FY 2018		FY 2019		FY 2020 Base		FY 2020 OCO		FY 2020 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	13.587	8.354		12.591		8.525		-		8.525	Continuing	Continuing	N/A

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Army		Date: March 2019
Appropriation/Budget Activity 2040 / 7	**R-1 Program Element (Number/Name)** PE 0607131A / *Weapons and Munitions Product Improvement Programs*	**Project (Number/Name)** ER6 / *Direct Fire Technology*

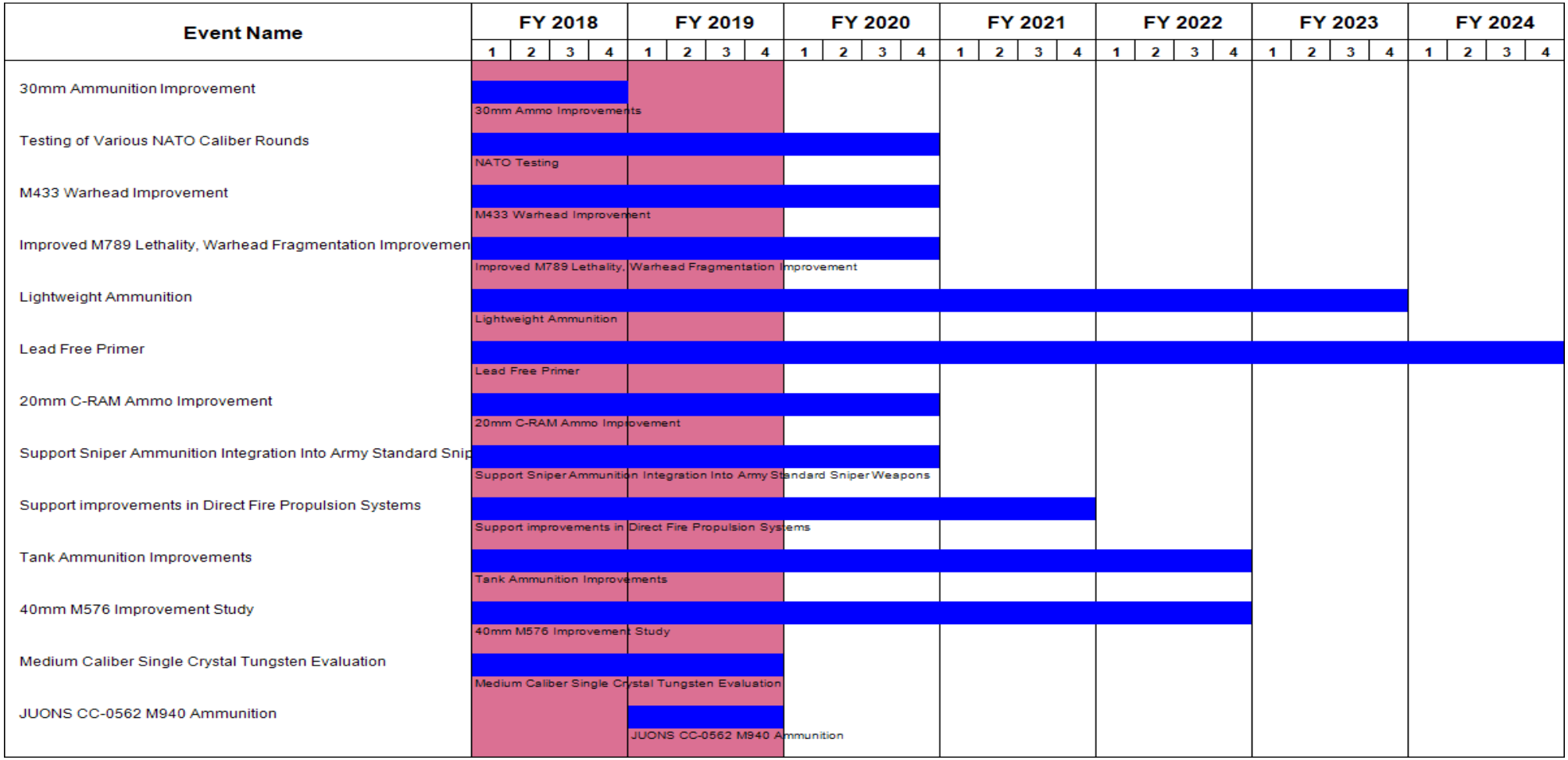

Exhibit R-4, RDT&E Schedule Profile: PB 2020 Army		Date: March 2019
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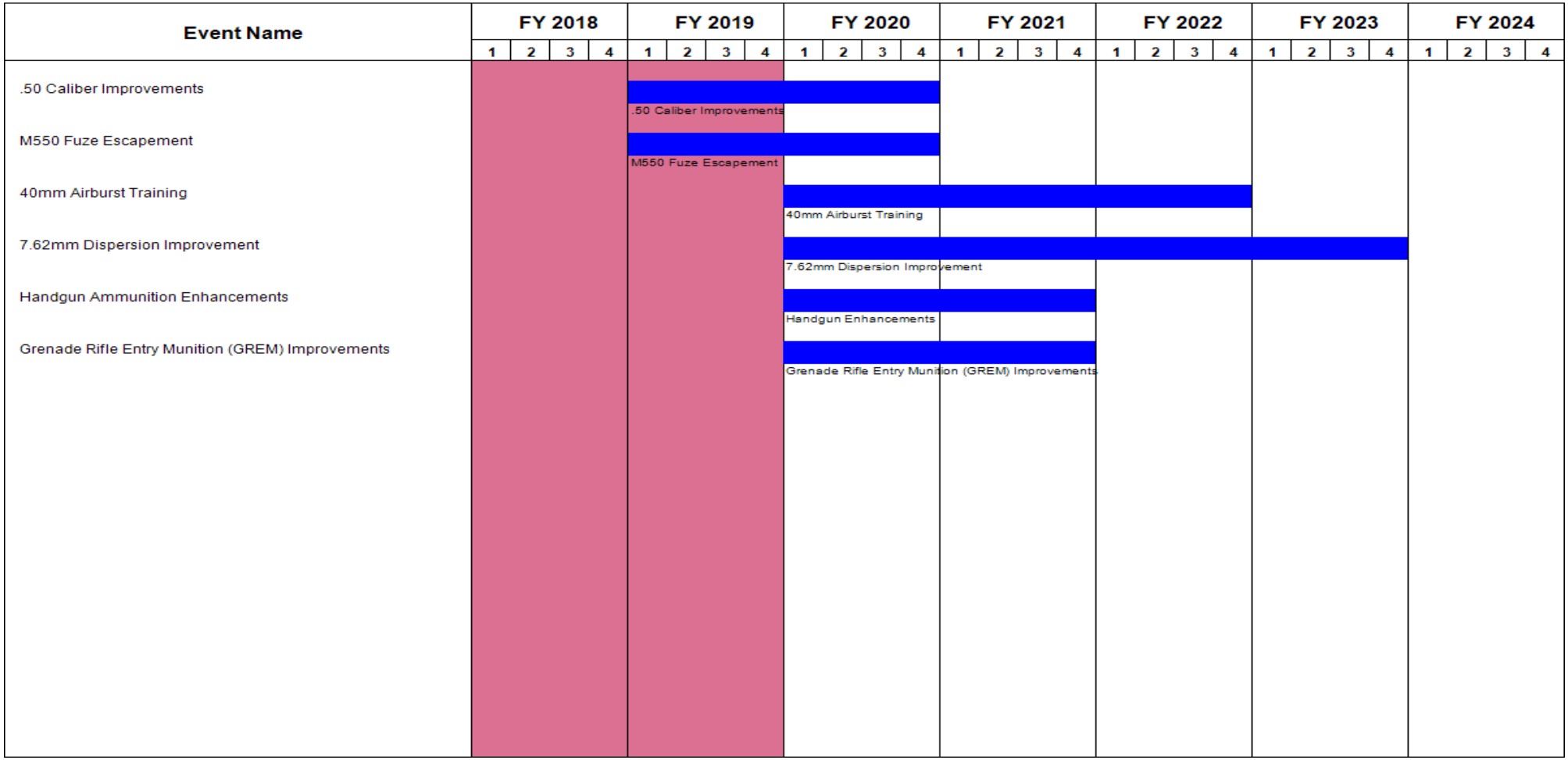

Exhibit R-4A, RDT&E Schedule Details: PB 2020 Army		Date: March 2019
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Schedule Details

	Start		End	
Events	**Quarter**	**Year**	**Quarter**	**Year**
30mm Ammunition Improvement	1	2018	4	2018
Testing of Various NATO Caliber Rounds	1	2016	4	2020
M433 Warhead Improvement	1	2015	4	2020
Improved M789 Lethality, Warhead Fragmentation Improvement	1	2015	4	2020
Lightweight Ammunition	1	2015	4	2023
Lead Free Primer	1	2015	4	2024
20mm C-RAM Ammo Improvement	1	2017	4	2020
Support Sniper Ammunition Integration Into Army Standard Sniper Weapons	1	2017	4	2020
Support improvements in Direct Fire Propulsion Systems	1	2017	4	2021
Tank Ammunition Improvements	1	2018	4	2022
40mm M576 Improvement Study	1	2018	4	2022
Medium Caliber Single Crystal Tungsten Evaluation	1	2018	4	2019
JUONS CC-0562 M940 Ammunition	1	2019	4	2019
.50 Caliber Improvements	1	2019	4	2020
M550 Fuze Escapement	1	2019	4	2020
40mm Airburst Training	1	2020	4	2022
7.62mm Dispersion Improvement	1	2020	4	2023
Handgun Ammunition Enhancements	1	2020	4	2021
Grenade Rifle Entry Munition (GREM) Improvements	1	2020	4	2021